

LM385 Feedback Provides Regulator Isolation

National Semiconductor
 Application Note 715
 Robert Pease
 Fran Hoffart
 November 1990



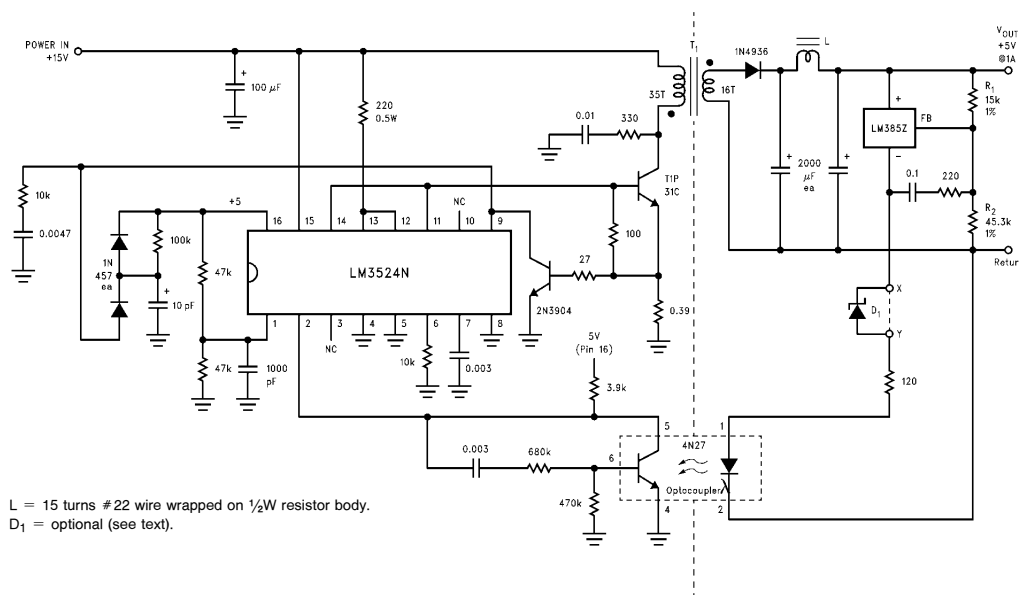
LM385 Feedback Provides Regulator Isolation

You can use a conventional 4N27 optocoupler in a feedback arrangement (*Figure 1*) to design a switching regulator with a floating output. The LM3524 switch-mode-regulator IC is configured as a simple flyback power supply with transformer-isolated output. The LM385 acts as a reference and comparison amplifier that satisfies the 4N27's current demands for balancing the dc feedback to pin 2 of the LM3524, thereby closing the loop. The LM385 automatically compensates for any LED degradation or optical-coupling loss.

The 4N27 specs a 0.1 dc to 1.6 dc gain range; the ac gain varies from 0.05 to 1.0. Fortunately, the "Miller" damper

from pins 5 to 6 nullifies the effect of the wide gain variance. Moreover, the damper provides excellent loop stability for a wide range of 4N27 optocouplers from several manufacturers. In the example shown, the LM385 provides 0.5 mA to 5 mA to the optocoupler.

If the 5V output available from this circuit does not meet your needs, choose $R_2 = R_1 (V_{OUT} - 1.25) / 1.25$. If V_{OUT} is greater than 6V, insert a zener diode between points X and Y, with $V_Z = V_{OUT} - 5V$; this addition prevents the voltage across the LM385 from exceeding its 5.3V max limit. The circuit is suitable for regulated output voltages from 3.2V to 25V.



L = 15 turns #22 wire wrapped on 1/2W resistor body.
 D1 = optional (see text).

TL/H/11049-1

FIGURE 1. Optocoupler-based feedback circuit produces galvanically-isolated, regulated voltages. The heavy negative feedback compensates for wide variations in optocoupler gains. The values portrayed in this schematic yield 5V output; by varying R_2 , you can obtain voltages from 3.2V to 25V.

AN-715

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



National Semiconductor Corporation
 2900 Semiconductor Drive
 P.O. Box 58090
 Santa Clara, CA 95052-8090
 Tel: 1(800) 272-9959
 TWX: (910) 339-9240

National Semiconductor GmbH
 Livny-Gargan-Str. 10
 D-82256 Fürstenfeldbruck
 Germany
 Tel: (81-41) 35-0
 Telex: 527849
 Fax: (81-41) 35-1

National Semiconductor Japan Ltd.
 Sumitomo Chemical
 Engineering Center
 Bldg. 7F
 1-7-1, Nakase, Mihama-Ku
 Chiba-City,
 Chiba Prefecture 261
 Tel: (043) 299-2300
 Fax: (043) 299-2500

National Semiconductor Hong Kong Ltd.
 13th Floor, Straight Block,
 Ocean Centre, 5 Canton Rd.
 Tsimshatsui, Kowloon
 Hong Kong
 Tel: (852) 2737-1600
 Fax: (852) 2736-9960

National Semicondutores Do Brazil Ltda.
 Rue Deputado Lacorda Franco
 120-3A
 Sao Paulo-SP
 Brazil 05418-000
 Tel: (55-11) 212-5066
 Telex: 391-1131931 NSBR BR
 Fax: (55-11) 212-1181

National Semiconductor (Australia) Pty, Ltd.
 Building 16
 Business Park Drive
 Monash Business Park
 Nottingham, Melbourne
 Victoria 3168 Australia
 Tel: (3) 558-9999
 Fax: (3) 558-9998

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.